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THE SIGN OF THE ORBICULARIS IN PERIPHERAL FACIAL PARALYSIS.[1]

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The divergence of views as to the course of the central neurones of the facial apparatus has always been very great.

All of our knowledge had been derived from pathologico-anatomical, and experimento-physiological observations; clinical study failed to cast any material light upon the subject, because all deductions from clinical observations were dependent upon the assumption that in facial paralysis due to central affections, the temporo-facial branch of the facial nerve was not involved, and that in ordinary hemiplegia the upper part of the face entirely escapes being paralyzed.

In order to explain this non-involvement of the upper facial, certain older authors questioned whether the upper facial had any cortical origin whatsoever, and believed that its only central source was from the nucleus of the fourth ventricle. Others (Huguenin, Chvostek and Hallopeau), while admitting a cortical origin, assume that the upper facial reaches the facial nucleus from the cortex by means of a course, separate from that of the lower facial; while still other and later observers have assumed that separate centers exist in the cortex for the upper and lower facial, that for the lower facial lying in the lower extremities of the frontal convolutions, while that for the upper facial was variously assumed to lie in the second frontal convolution at its junction with the precentral (Ferrier, Horsley, Hitzig and Duret), or in the inferior parietal lobule (Mendel, Exner and Paneth, and Obersteiner).

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[1] Read at the meeting of the American Neurological Association, May 12, 13 and 14, 1903.

More recent clinical observations have, however, shown that the assumption of non-involvement of the upper facial in hemiplegia is a mistake. The recognition of this long dominant error in clinical knowledge is due in great part to the sign of the orbicularis (Signe de l'orbiculaire de la paupière). This name was first suggested by Révilliod to describe a symptom which was already known but which he above all others has most carefully studied and utilized for scientific deductions.

This symptom consists in the inability of a hemiplegic, voluntarily to close the eye upon the paralyzed side, except in conjunction with the other eye.

Thus in cases of hemiplegia, the temporo-facial branch of the facial nerve is often so slightly affected as to lead to doubt whether the upper facial territory is involved at all.

If in such a case the hemiplegic be asked to close both eyes together, he is able to do so without difficulty; he is also able to close the eye upon the sound side while keeping the eye upon the affected side open, but he is unable to reverse this procedure and close the eye upon the paralyzed side while keeping that upon the unaffected side open.

This sign of the orbicularis was found by Révilliod as well as by subsequent observers, Boiadjiew, and Bard, to be present in almost all hemiplegics, and this not only for a short time after the apoplectic attack, but frequently persisting for a long time after all other signs of paralysis have passed away.

Every subsequent investigator has been able to corroborate these earlier observations, so that as a result of this, and other clinical signs which do not concern us here, it is today universally admitted that the upper facial is involved in all central affections of the facial nerve, although to a less extent than is the lower facial.

This being acknowledged, it is also clear that the various assumptions regarding the dissociate cortical origin of the upper facial are superfluous and the most modern authors agree with Mills who sums up the central course of the facial as follows:

"The central neurones of the facial apparatus arise from the motor cells of the lower extremities of the central convolutions. Together they form a tract which passes by the corona radiata and the internal capsule about its knee to the tegmentum, decussating in the latter to enter the facial nucleus of the other side."

If, however, the implication of the upper facial in the central paralysis is a generally recognized fact, it must be admitted on the other hand also that the upper facial in such paralysis is always relatively free, that it is rarely as much involved as the middle and lower facial or as much as the upper facial is involved in peripheral paralysis.

This fact requires explanation!

Why is the upper facial relatively free in central paralysis?

A priori, it may be reasoned, the functions of the upper and lower facial territories differ materially, the upper being utilized more for emotional movements, while the middle and lower serve more for voluntary ones: that emotional movements are as a rule bilateral, while voluntary ones may be either unilateral or bilateral; that, furthermore, inasmuch as the voluntary movements in cerebral hemiplegia due to lesion of the pyramidal tracts, are the ones most affected, it will be comprehensible that the middle and lower facial muscles will be more markedly involved than those supplied by the upper branch of the facial nerve.

This reasoning presupposes a special path, not through the internal capsule, for emotional movements, or it warrants the assumption that each upper facial is innervated from both hemispheres. While the first assumption is by many considered correct, it would, however, in the case of cortical or subcortical lesions (that is, involvement of the purely voluntary motor paths), necessitate equable paralysis of all parts of the facial, which is contrary to all clinical experience.

The other assumption was first advanced in a general way by Broadbent, and is almost universally accepted as a fact.

Broadbent's hypothesis in the main represents the following ideas: Many muscles of the body are used only in conjunction with their fellows of the opposite side; others while usually used alone may be and frequently are used conjointly with their fellows. Those muscles which are always used alone are represented only unilaterally in the cortex; those that are used conjointly are bilaterally represented, so that unilateral movements can be excited only from one, the opposite hemisphere, while bilateral movements can be excited from either hemisphere, and finally those muscles which are sometimes used alone and at other times conjointly are connected with both hemispheres, but are generally excited from one, the opposite hemisphere, only.

The synergic action of the orbiculares palpebrarum, during repose or during a state of unconsciousness, shows that they must have a bilateral innervation and that they must, therefore, be excitable together from either hemisphere. As a result of education and under influence of the will each orbicularis may in its action become independent of the other, and must then be excitable individually from the contralateral hemisphere. Such conjoint and independent actions can be explained only by the assumption of a chiasm formation, an interlacement composed of two crossed and two direct tracts. Therefore Révilliod, starting from the hitherto accepted premise that the sign of the orbicularis is never present in peripheral paralysis, but is found only in central affection, seeks this chiasm formation at a point on the motor path between the cortex and the nucleus. Révilliod says: "If indeed, as the sign of the orbicularis has demonstrated, the superior facial is really implicated in ordinary hemiplegia together with and by means of the same focus as the lower facial and the extremities, then it must form part of the same tract, called pyramidal, and course with it from the cortex to the oblongata, passing by way of the internal capsule. But in order to assure the synergy of the two sides of the upper face, this nerve must divide before reaching its nucleus, into two branches, the one crossed, the other direct, the latter returning to the face upon the same side as the hemisphere from which it emanates," and "the crossed branch would consequently always be accompanied and assisted into its end ramifications, by the direct branch which comes from the hemisphere of the opposite side." This explanation Révilliod illustrates by a diagram of the motor tract in which the decussation of nerve fibers is shown to be complete for the lower facial (and the extremities) but is assumed to be incomplete for the synergic muscular groups of which the orbiculares form a morphological part.

Révilliod's assumption may be endorsed but at the same time may be considered insufficient.

If we recall that the upper facial also in other pathological conditions than that of central hemiplegia may show a comportment different from that of the middle and lower distributions; that in bulbar paralysis it is almost the rule to find the upper facial relatively less implicated than the lower facial, and that even in purely peripheral facial paralysis the temporo-facial branch is not infrequently much less affected than is the lower facial, then we are entitled to assume, not only as has been done by others, that the upper facial is especially resistant to pathological influences, but also that a decussation of fibers must take place at the facial nucleus itself and that this decussation is mainly made up of those fibers which act synergically.

This question of decussation of facial fibers is one which anatomical and physiological investigations, as well as pathological studies, have been unable to answer definitely.

A priori, and reasoning from analogy it would seem that such decussation must exist. Clinically we know that in complete hemiplegia, not only is, as has already been emphasized, the orbicularis palpebrarum relatively free, but also that the eye muscles, the muscles of the trunk and of the larynx, in short all those muscles which usually functionate in pairs and give rise to bilateral associated movements are comparatively unaffected.

This can be explained only if we admit the existence of commissures joining the nuclei of origin of the motor nerves of the two sides, such commissure then assuring functional physiological synergy, and reciprocal subserviency in pathological implication of the nucleus upon one side.

As a general principle the existence of such decussation between the homologous nuclei of all motor cranial nerves is admitted (see Edinger), but it is not admitted as a fact by all observers for all cranial nerves.

Thus as regards the facial, we find that Adolf Meyer, C. Mayer, Van Gehuchten and Bischoff have furnished proof in opposition to the doctrine of decussation between its roots.

On the other hand, Obersteiner, von Bechterew, Flatau, Marinesco, Bruce, Kotelewsky, Mills, Pardo and Bary are supporters and have furnished anatomical proof of the existence of such decussation.

Recent observations of Ramon y Cajal are also in accord herewith and clearly show that fibers belonging to the seventh nerve decussate in the raphè.

Of special interest and value in this connection, are the experiments of J. and N. Aspisow. These observers after having, by means of electric excitation, located the cortical center for the upper facial in dogs, excised this center and after proper lapse of time examined the brain.

In addition to secondary degeneration through the corona radiata, internal capsule, crus and pons, the degenerated fibers could be plainly traced from the homolateral, across the raphè, to the contralateral facial nucleus.

Against all this anatomical proof, however, stood the clinically accepted fact that the sign of the orbicularis was absent in peripheral paralysis. As a result of my examination of all the cases of peripheral facial paralysis which I have seen in hospital and private practice, since the last four years, I am able now to say that this so-called fact is an error, and that the sign of the orbicularis can be found in many peripheral cases if sought for at the proper time.

Already in 1894 Mann, in calling attention to the fact, which had also been recorded by a number of others, that the orbicularis oculi in some cases of peripheral paralysis is not nearly so much involved as the other facial muscles, and that this same muscle in cases which are improving shows an early regeneration, also states that in these same cases the patients were able to close the eyes at a time when the attempt to corrugate the forehead failed; the forehead upon the paralyzed side remaining smooth but the eye closing.

If this investigation be probed further, it will be found that while many such patients can at this time close both eyes together, the independent closure of each eye is possible only for the eye upon the unaffected side.

Before this test can be utilized for deductions or conclusions of any kind, it must, however, be first shown that the independent closure of each eye exists physiologically in the majority of individuals. This has been demonstrated by Boiadjiew, who tested

750 healthy persons, and found that 484 or 64.54 per cent could close each eye independently; 126, or 16.80 per cent, could close only the left eye without at the same time closing the right; 64, or 8.53 per cent, could close only the right eye without at the same time closing the left; 76, or 10.13 per cent, could close neither the left nor the right eye independently of the other.

This investigation, therefore, shows that two-thirds could close either eye independently and that, therefore, this capability is sufficiently frequent to allow its absence to be utilized as a clinical symptom, provided the patient can give a history of previous independent control.

There is no necessity for giving a large number of cases in order to demonstrate the frequent occurrences of a symptom which any observer may easily corroborate. Let us take a few typical cases which present points of special interest.

Thus, W. W. O., male, aged thirty-seven, was seen on October 16, 1899; he had then been afflicted with a peripheral paralysis of the right facial nerve since a few days. There was marked lagophthalmus, with inability to corrugate the forehead, complete R. D. in all the muscles supplied by the facial nerve, including the orbicularis oculi; no disorder of taste nor of hearing. Ten days after onset of the paralysis, with R. D. still existing in all the facial muscles, including the orbicularis, and while still unable to corrugate his forehead, to whistle or to blow out a light, he could close both eyes together, but could not close the right eye independently of the left. He could close the eye upon the sound side, alone; he could close the affected eye when the other eye was closed, but he could not close the affected eye alone when the unaffected eye was kept open.

Two weeks later he was able to close each eye freely and independently of the other, as he had always been able to do prior to the onset of the paralysis.

The following case shows the long persistence of an untreated facial paralysis, the improvement comparatively soon after treatment was instituted and the supervention of the sign of the orbicularis contemporaneously with the onset of improvement.

A. L., a young boy, was operated for mastoiditis; after coming out of the narcosis it was noted that he had a complete left-sided facial paralysis. For one and one-half years he was subjected to much treatment on account of his ear trouble, but no attention was given to the facial paralysis. At the time when I first saw him he still showed complete paralysis of the entire facial with marked R. D. in all the muscles supplied by this nerve, no faradic response being obtainable in a single muscle. After five months' electrical treatment, faradic reactions set in in the temporo-facial as well as in the lower facial, but not so marked here as there; at the same time functional improvement took place in the upper facial alone and he was soon able to close the eye completely. He could, however, not close the affected eye without also closing the sound one.

Four weeks later, while still showing R. D. in the entire upper and lower facial territory, he was able freely to close each eye separately.

The mother states that prior to the facial involvement he was able to wink each eye alone.

The last case which I will briefly relate is of interest because it was a case of peripheral facial paralysis with apparent freedom of the orbicularis, which, however, through the presence of the sign, was shown to be an ordinary case with but slight involvement of the upper branch.

The patient, a middle-aged woman, was seen in March, 1900, three days after the acute onset of a right-sided facial paralysis. Examination showed marked involvement of the lower facial, as shown by the interference with mouth movements (whistling, blowing, grinning, etc.), with apparent freedom of the upper facial. She was able to close both eyes completely and easily. When each eye was tested separately it was, however, found that she could close the left eye alone with ease, but that she could not close the right at all except in conjunction with the other eye.

She made a rapid and complete recovery and was then able to close each eye singly as she had been able to do prior to the onset of the paralysis.

Without citing any more cases I desire to call attention to a result of my investigation which seems to me to bear some prognostic significance. As well as it has been recognized that in peripheral paralysis of the facial nerve, the orbiculo-frontal branches are frequently less implicated or recuperate earlier than the other branches, so also it is well known that marked spasm and twitchings may occur in the orbiculo-frontal territory, at a time when the voluntary path is being reëstablished, and at a time in which reduced electrical excitation still exists. In what percentage of cases such spasms occur, I do not know, but the number is probably not small; I am, however, able to state with certainty that in no case which I have followed during the last four years has such spasm occurred after the sign of the orbicularis, which had been present, had passed away; or I may say in all cases in which the spasm has occurred the patient was not able to close each eye independently at the time of the onset of the spasm.

In conclusion I would summarize the result of my studies as follows:

1. The statement of Bard, that the sign is invariably lacking in peripheral facial paralysis and is, therefore, a distinguishing mark of central affection, is incorrect.
2. The presence of the sign in peripheral paralysis is further proof of the existence of commissural fibers between the nuclei of the 7th nerves.
3. The sign is of clinical value in so far as its presence in peripheral paralysis shows that complete recovery has not yet occurred.
4. The secondary over-action in the orbicularis palpebrarum, which is late in appearance and always coincides with some recovery in power, does not occur in those cases in which the sign having been present has passed away.

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